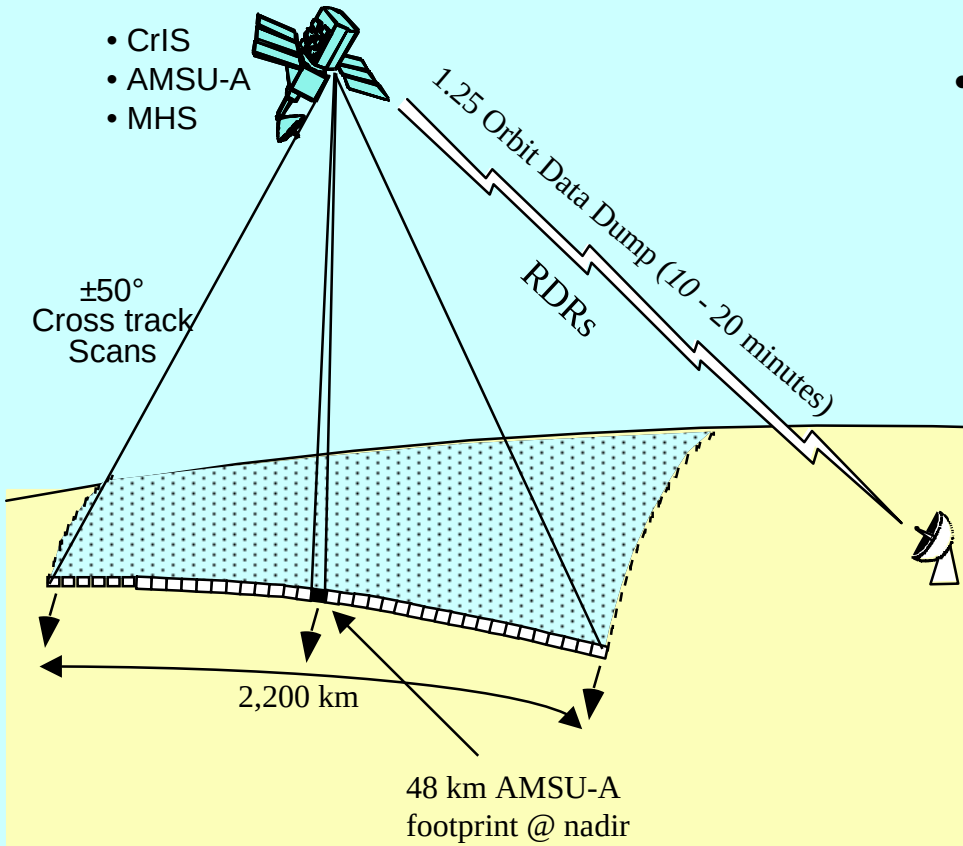
Crosstrack Infrared Sounder (CrIS) Overview

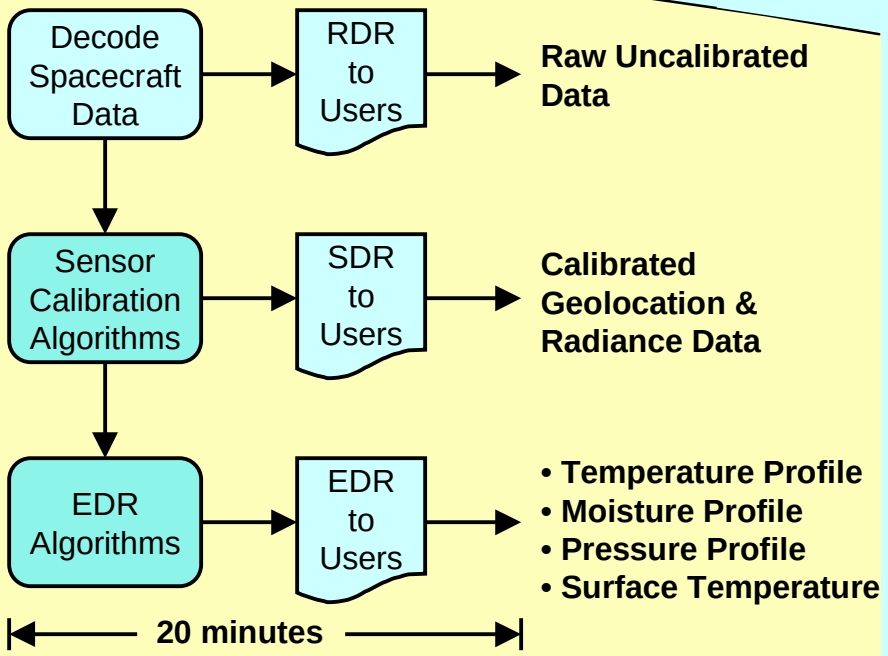
December, 1999

CrIS Overview

CrIS is Part of the Overall CrIMSS Sensor Suite



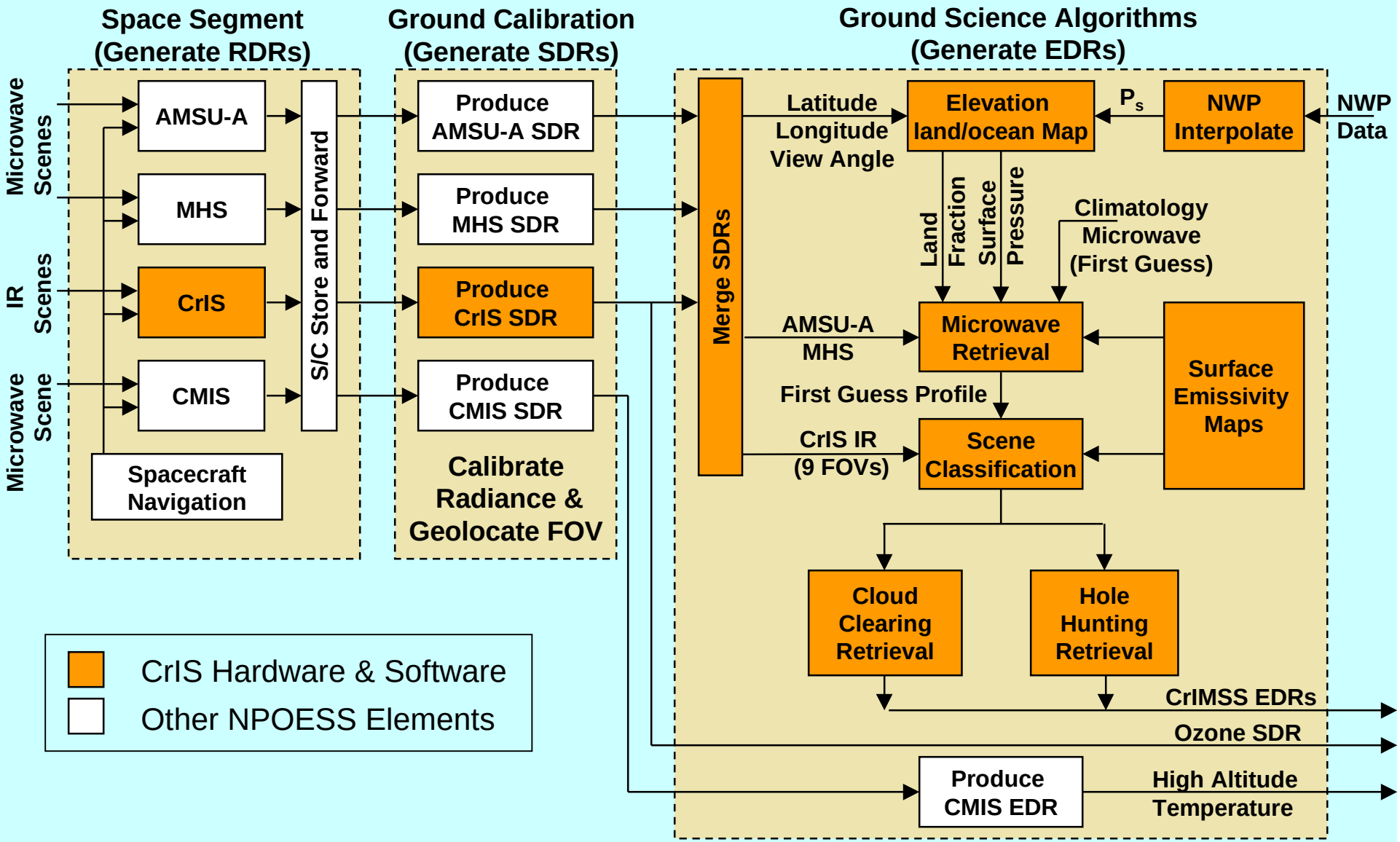
- **CrIMSS* Functions**
  - **Collect Raw IR & MW Radiance Data**
  - **Store & Downlink 1.25 Orbits of Data**
  - **Calibrate Sensor Data & Geolocate Footprints**
  - **Convert calibrated sensor data to atmospheric profiles**



RDR = Raw Data Record (uncalibrated)
SDR = Sensor Data Record (calibrated)
EDR = Environmental Data Record

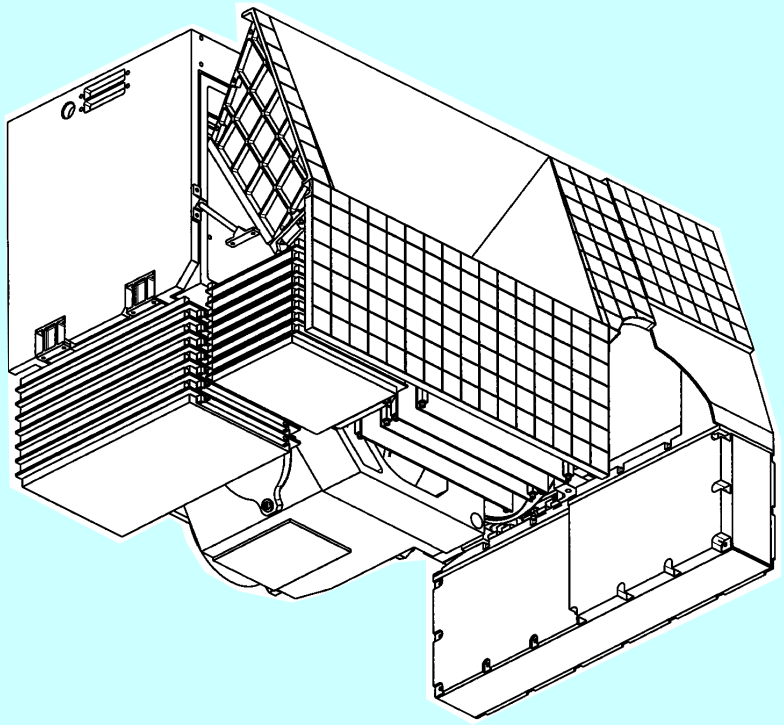
*Cross-track Infrared and Microwave Sensor Suite

Overall Architecture for Generating CrIMSS Data Products



Baseline CrIS Sensor Design

- 8 cm Clear Aperture
- 4-Stage Split-Patch Passive Cooler
  - 81K LWIR patch temperature
  - 98K MWIR/SWIR patch
- High-Performance PV Detectors
- 3 x 3 Arrays (14 km IFOVs)
- 3 Spectral Bands
- All-Reflective Telescope
- Proven Bomem Plane-Mirror Michelson Interferometer With Dynamic Alignment
- Deep-cavity Internal Calibration Target based on MOPITT design
- Two-Axis Scene Selection Module with Image Motion Compensation
- Modular design allows future addition of active cooler and larger than 3x3 arrays



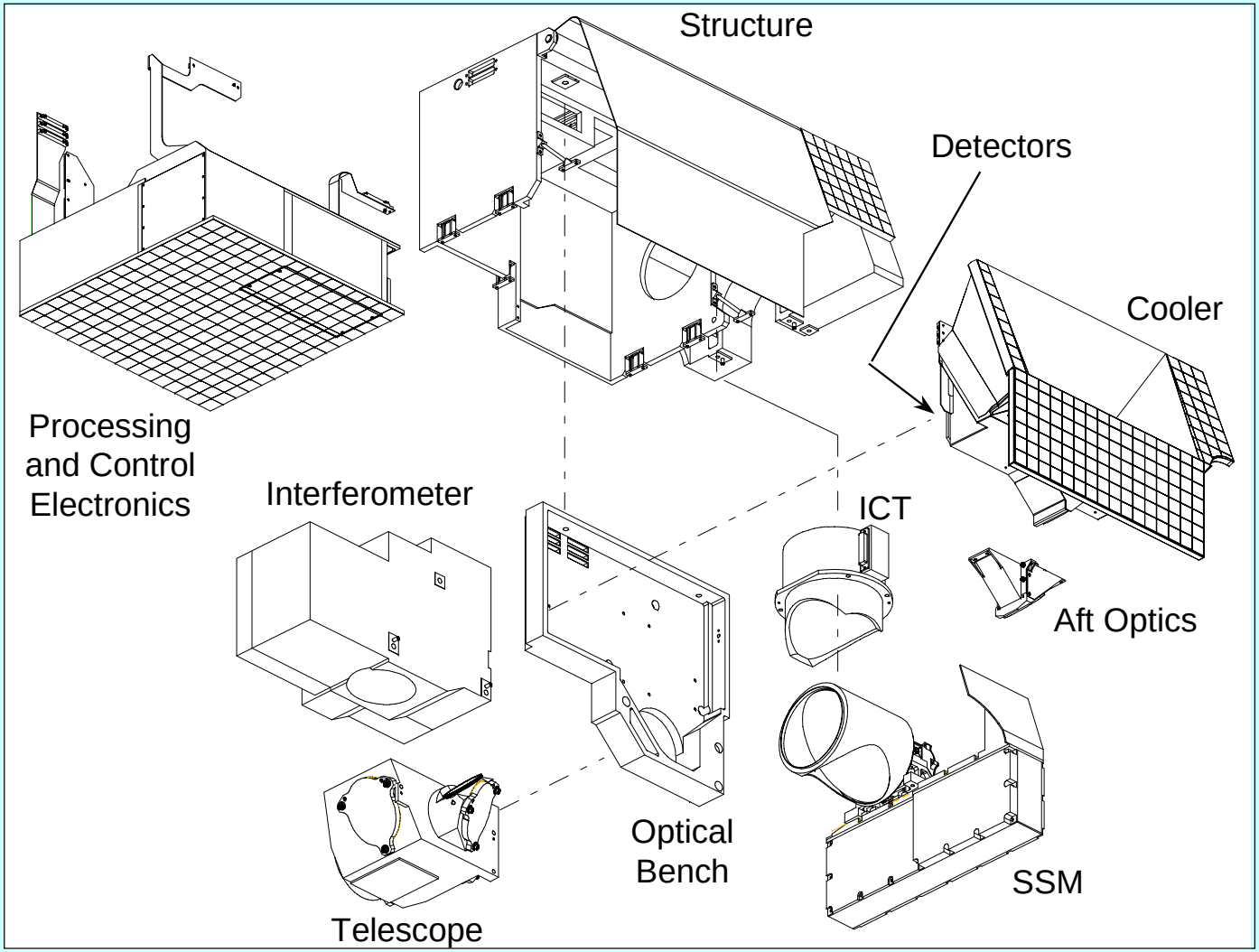
	Requirement	Baseline
Volume	61 x 40 x 40 cm	61 x 40 x 40 cm
Mass	< 81 kg	76 kg*
Power	< 91 W	86 W*
Data Rate	< 1.5 Mbps	1.48 Mbps*

**15% Margin Included*

Cost Effectiveness Improves When Sensor Functions Map Directly to Independent Modules

Our CrIS Sensor Consists of 9 Independent Single Function Modules

3-Dimensional Stable Instrument Frame



EDU1

Prototype CrIS Engineering Development Unit (EDU1) is Functioning

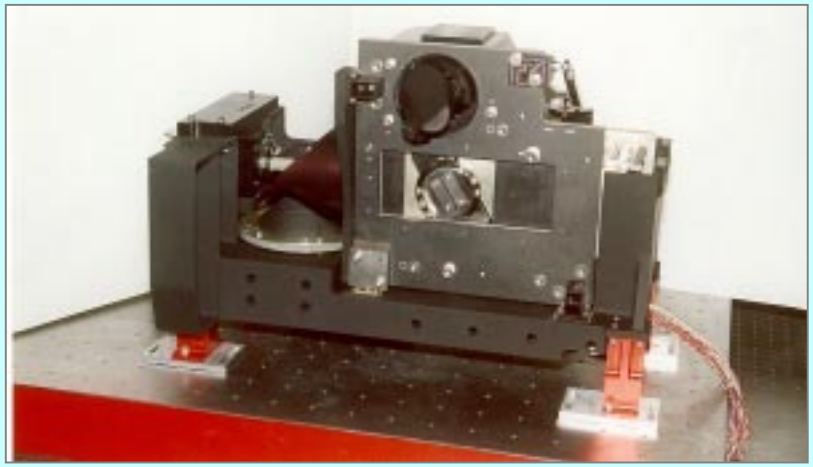
Fabricated, Assembled, and Tested in Less Than 6 Months

Proves Low-Risk Modular Features of CrIS Flight Design

Greatly Reduces Numerous Manufacturing / Assembly Risks

Key Lessons Learned Are Incorporated in Our Design

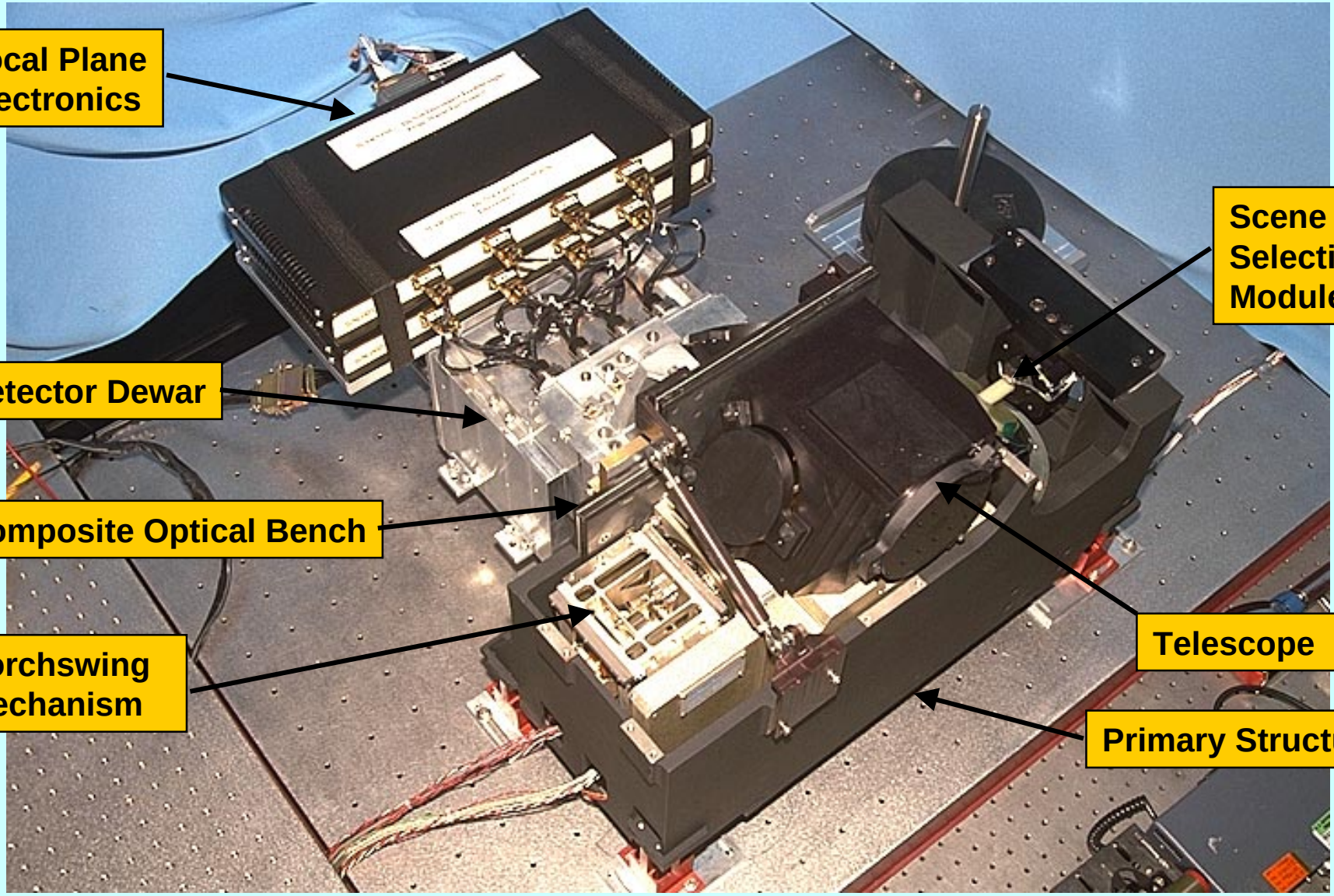
- **Working prototype of the complete CrIS sensor**
- **Uses elements of the 30 separate hardware demos conducted in support of the CrIS Phase 1 program**



- **Key Elements of EDU1**
  - **Complete interferometer using CrIS flight design**
  - **Advanced composite / alloy structure and optical bench**
  - **Telescope, aft optics, and detector optics using CrIS design**
  - **Deep-cavity ICT using CrIS flight design**
  - **Two CrIS PV FPAs and preamps developed by Boeing**
  - **Prototype signal processing electronics circuit card**
- **EDU1 is a critical part of post-downselect risk elimination strategy**

EDU1

Functional EDU1 Provides an Excellent Test Bed for Performance Assessment of CrIS Modules

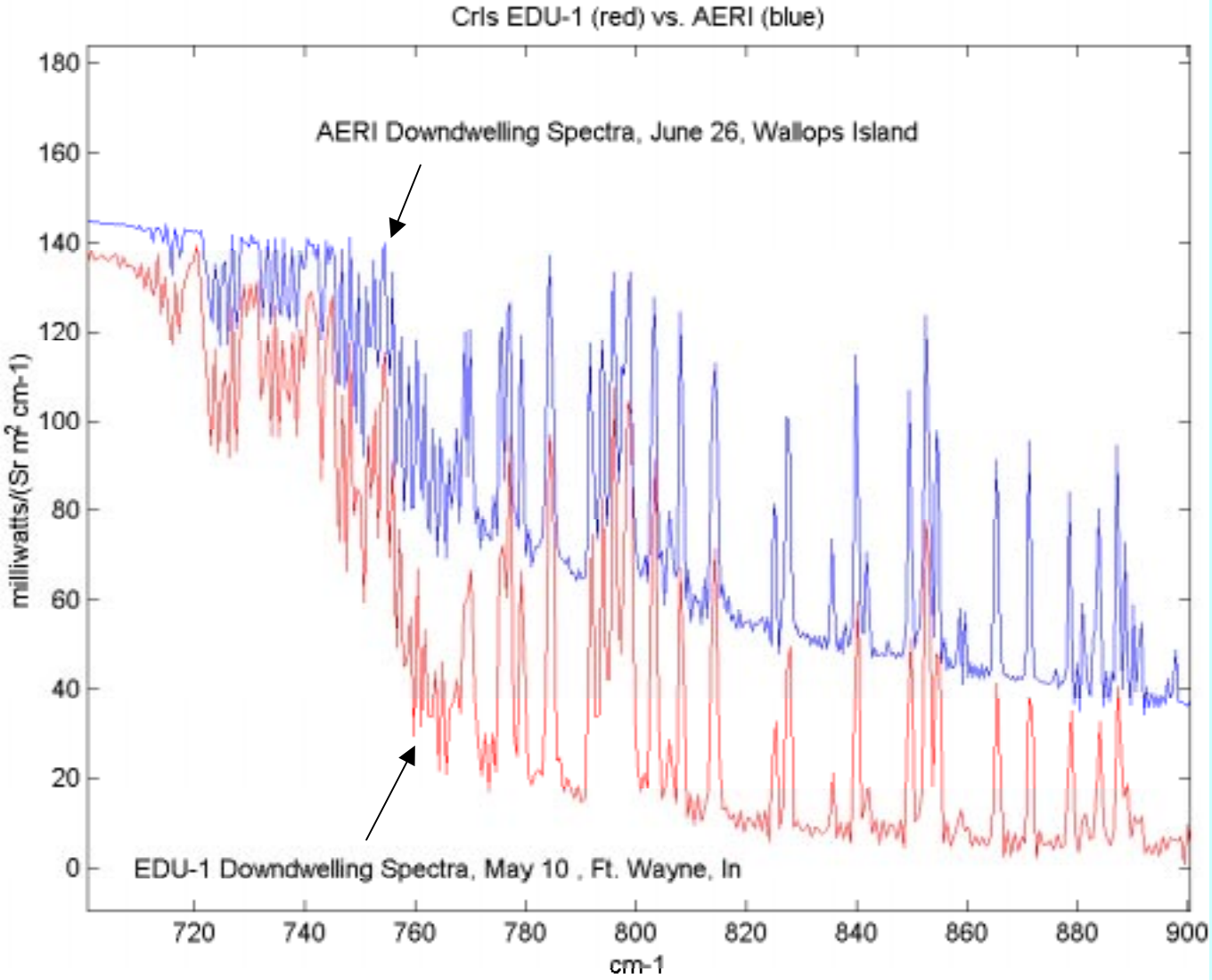


EDU1

Outdoor Testing of EDU1 Confirms Its Ability to Accurately Detect Atmospheric Features

EDU1 Resolves Important LWIR Atmospheric Features

Spectral Calibration Appears to Be Very Good



System Performance

Key CrIS Sensor Performance Parameters

All Sensor Performance Requirements Are Derived From EDR Performance Requirements

All Values Include Margins

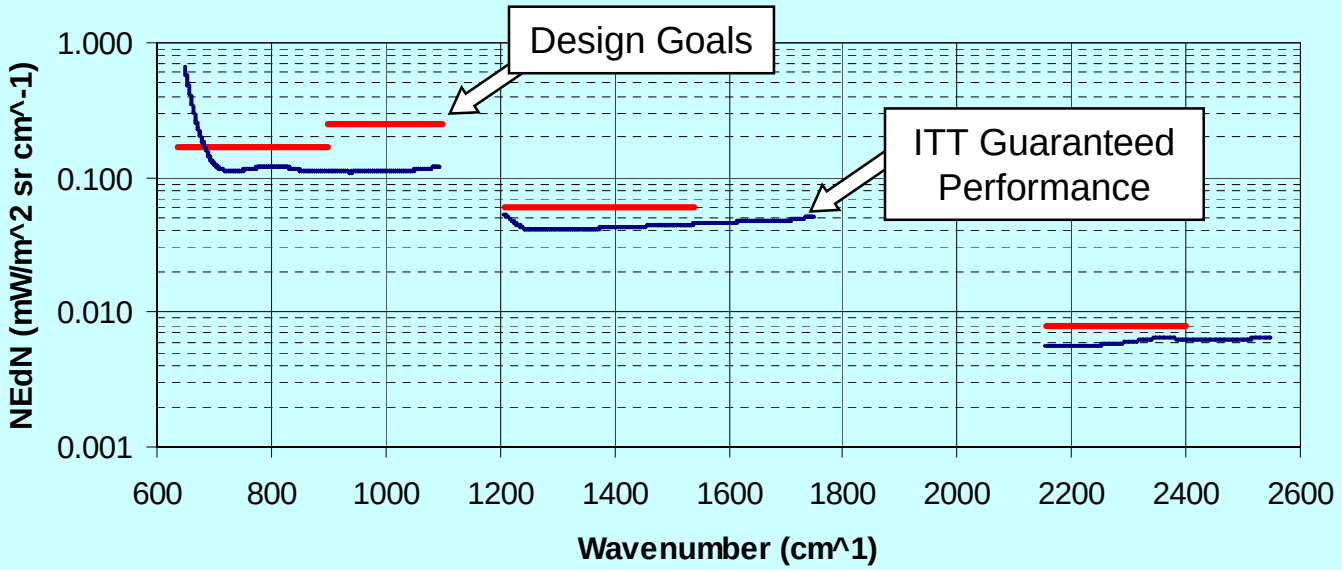
Sensor Parameter	Guaranteed Value
LWIR Band	650-1095 cm^{-1}
MWIR Band	1210-1750 cm^{-1}
SWIR Band	2155-2550 cm^{-1}
LWIR Spectral Resolution	< 0.625 cm^{-1}
MWIR Spectral Resolution	< 1.25 cm^{-1}
SWIR Spectral Resolution	< 2.5 cm^{-1}
Number of FOVs	3 x 3
FOV Diameter (Round)	14 km
FOV Motion (Jitter)	< 50 urad / axis
Mapping Accuracy	< 1.45 km
Absolute Radiometric Uncertainty	< 0.45% (LWIR) < 0.6% (MWIR) < 0.8% (SWIR)
Radiometric Stability	< 0.4% (LWIR) < 0.5% (MWIR) < 0.65% (SWIR)
Spectral Shift Errors	< 5 ppm

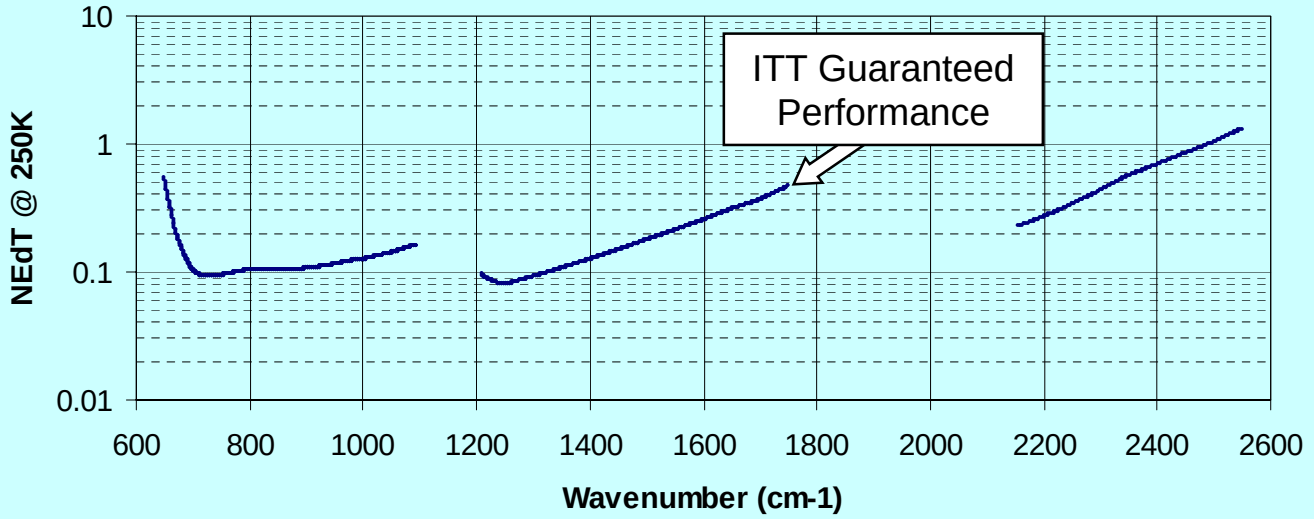
Guaranteed NEdN and NEdT Performance

NEdNs Are Much Better Than Government Design Goals

Values Include All Expected Error Effects

15% Margin Included in NEdNs and NEdTs

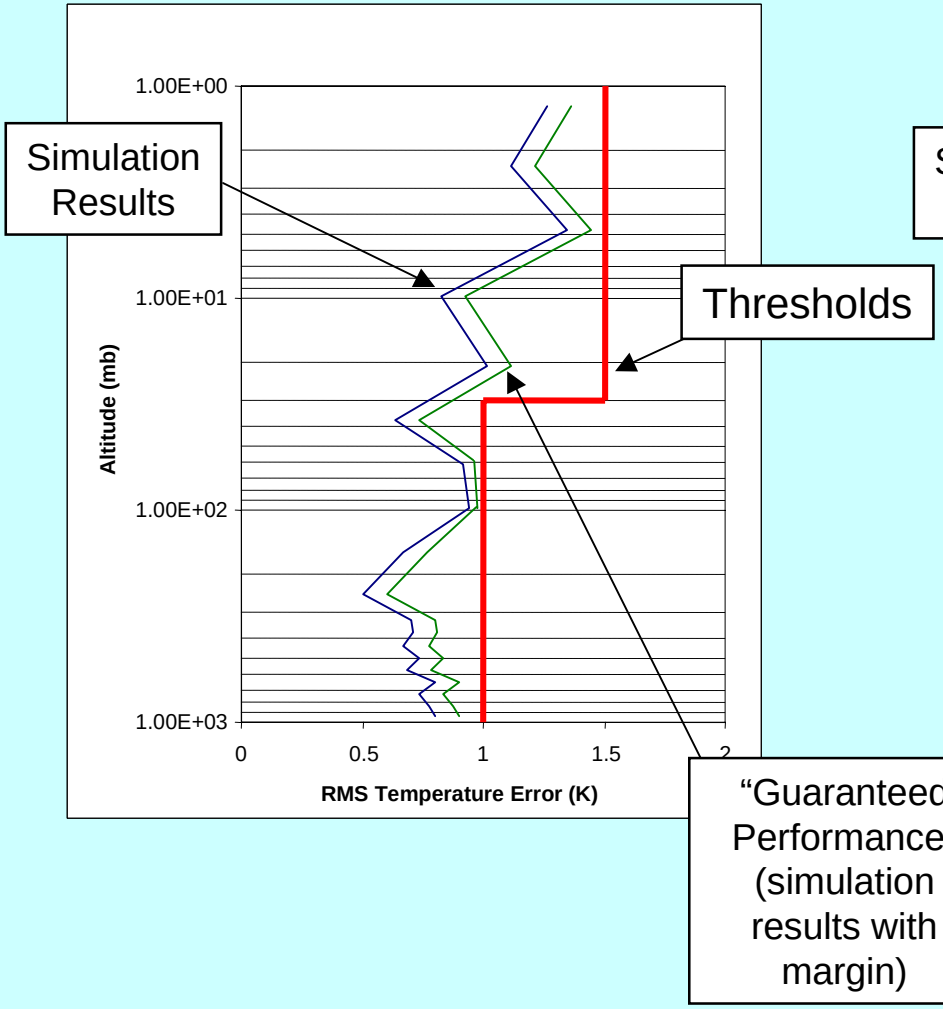




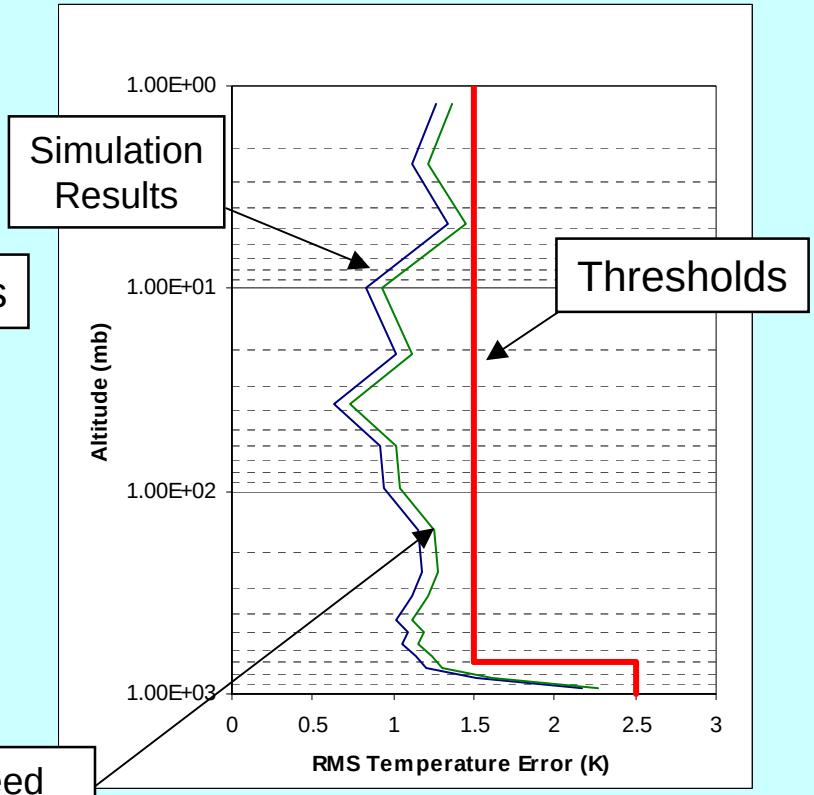
System Performance

Temperature Measurement Uncertainty Profiles

"Clear" Conditions (<50% Cloudy)



"Cloudy" Conditions (>50% Cloudy)



Summary

- **CrIS Sensor Provides a Quantum Leap Forward in Meteorological Sensor Capabilities**
- **CrIS Sensor Uses Proven Low-Risk Components to Provide Superb Operational Capabilities**
  - **Proven Bomem Plane-Mirror FTS Interferometer With Dynamic Alignment**
  - **Advanced Boeing PV detectors in all bands**
- **EDU1 Prototype Has Already Demonstrated Key CrIS Performance Capabilities**
- **Retrieval Performance Exceeds IPO Minimum Threshold Requirements Under All Conditions**